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4.17 Test of Three-dimensional Radionuclide Transport with Decay Chain

This test verifies that FEHM has correctly implemented the transport module when used to simulate a radionuclide decay-chain transport problem in three dimensions. Figures 60, 61, 62, and 62 compare the concentration-time curves for the radionuclide and conservative tracer that were simulated using both FEHM and TRACRN, the code used for comparison, at four different positions. Regarding the code comparison, the plots indicate that FEHM and TRACRN concentrations agree quite closely at the comparison points. Results from TRACRN are found in files *3d_tracr3d_cons.out* and *3d_tracr3d_am.out*. Considerable concentration errors can result from only a small displacement of a breakthrough curve along the time axis because of the steep rise or fall of the concentration-time curve for a typical case, as seen by the maximum percent errors, which varied from 3 to 15%. However, Table 59 indicates that the RMS errors of all species at each comparison point were less than 0.0042 (or 0.5%) for concentrations greater than 10% of their peak values. These results meet the acceptance criteria for this test suite developed in Chapter III.

| Table 59. Results of the test of the three-dimensional decay-chain problem			
V&V test	**Maximum error**	**Maximum % error**	**RMS error**
Conservative-tracer concentration versus time			
Point 1	0.5278e-01	6.878	0.1268e-02
Point 2	0.1590e-01	10.98	0.1834e-02
Point 3	0.3643e-02	4.605	0.8533e-03
Point 4	0.1006e-02	2.840	0.1245e-02
^{243}Am concentration versus time			
Point 1	0.4776e-01	7.290	0.1468e-02
Point 2	0.1569e-01	15.14	0.3431e-02
Point 3	0.1033e-02	12.77	0.3291e-02
Point 4	0.1965e-04	14.99	0.4166e-02

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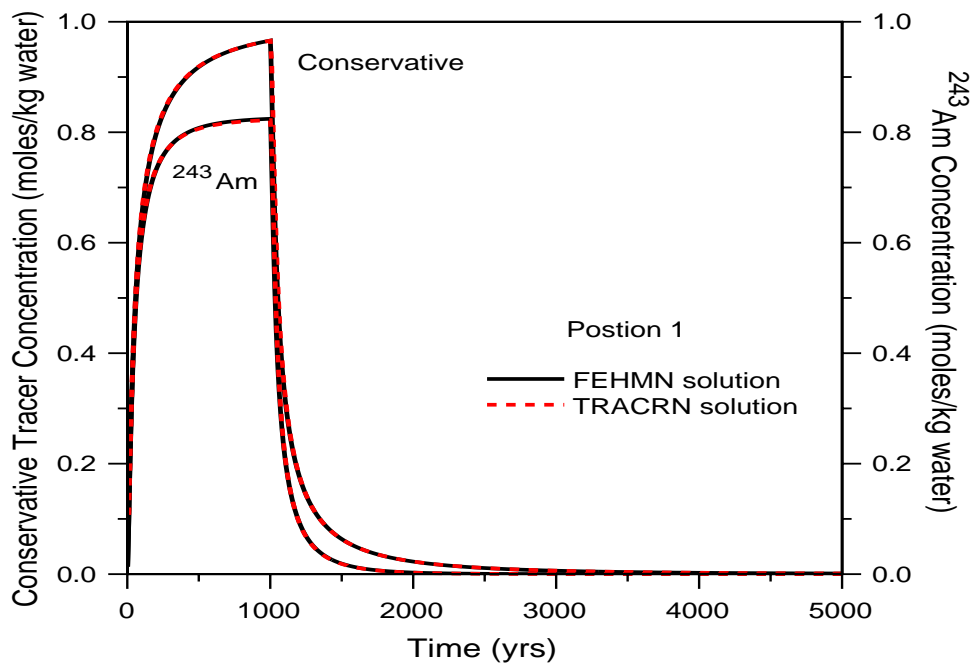
Figure 60. Comparison of FEHM and TRACRN results for the concentration-time history at position 1.
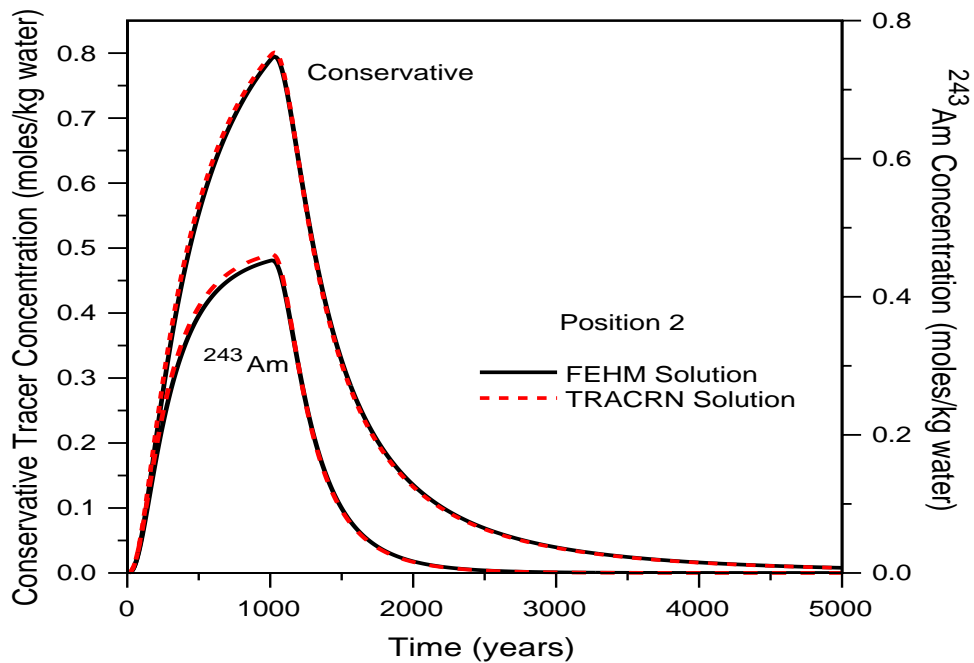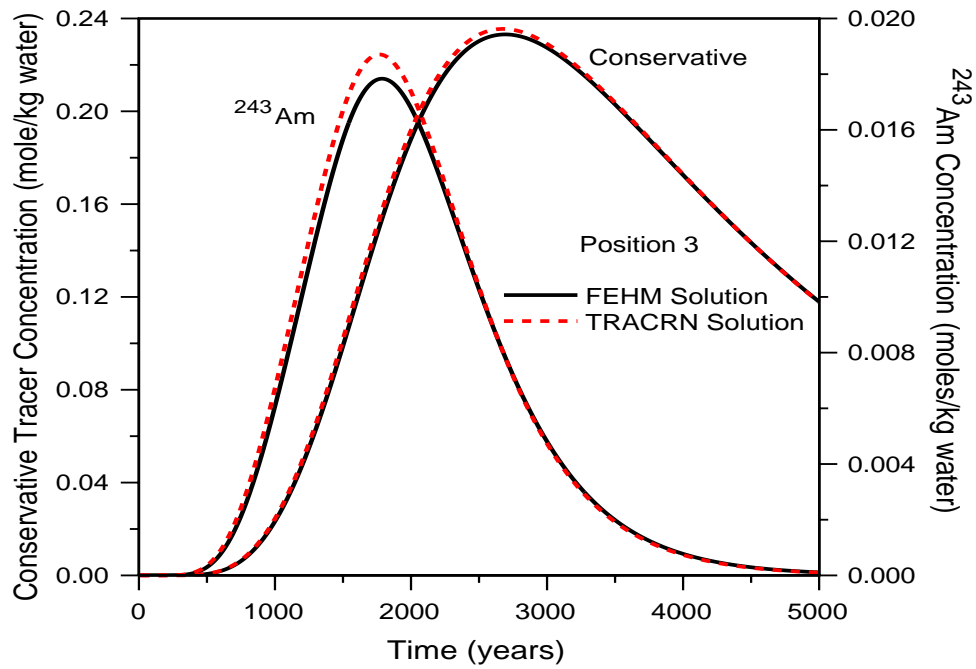

Figure 61. Comparison of FEHM and TRACRN results for the concentration-time history at position 2.

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**Figure 62. Comparison of FEHM and TRACRN results for the
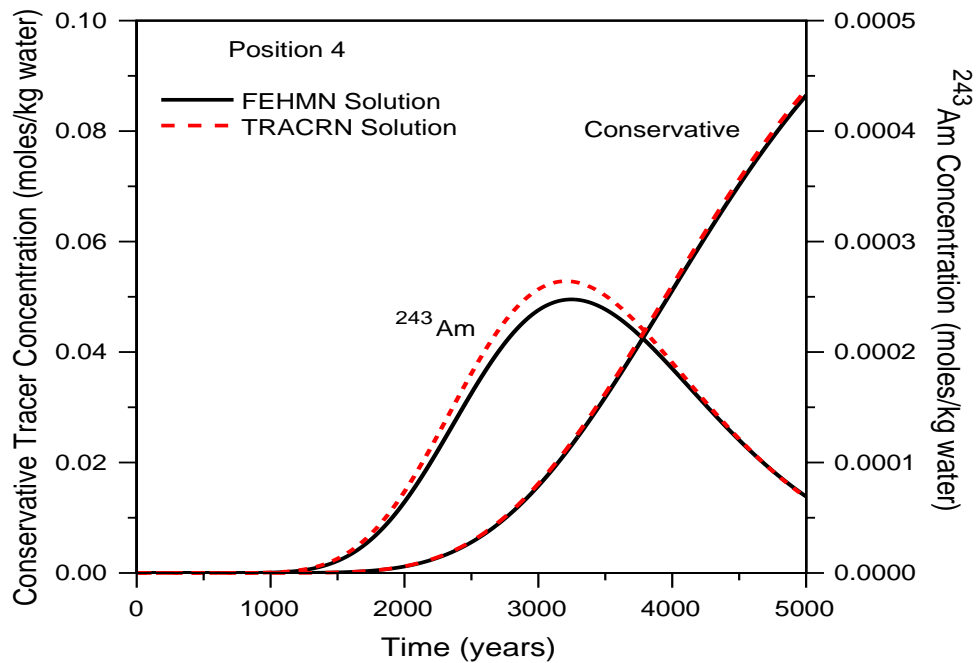concentration-time history at position 3.**

**Figure 63. Comparison of FEHM and TRACRN results for the
concentration-time history at position 4.**